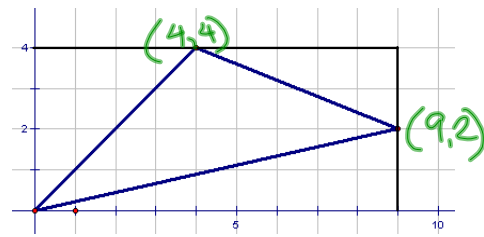
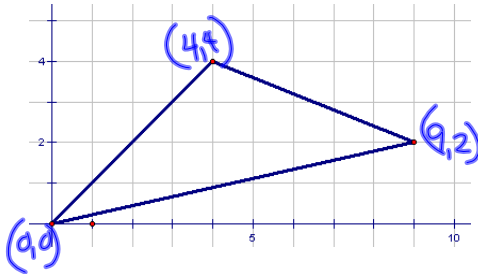
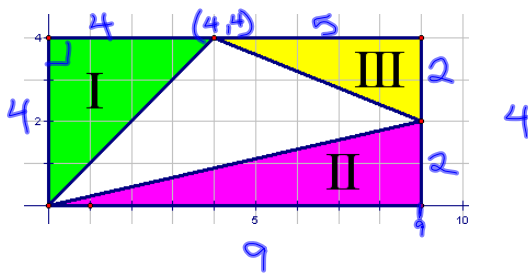


## Area by Determinants

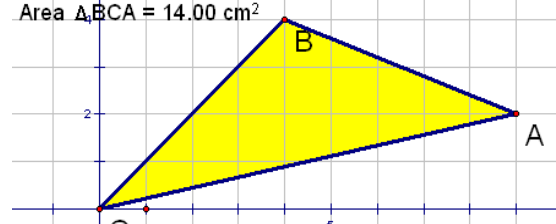
$$A = \frac{1}{2}bh$$



$$\frac{1}{2} \begin{vmatrix} 9 & 2 \\ 4 & 4 \end{vmatrix} = 14 \text{ u}^2$$



$$\begin{aligned} A_{\text{Rect}} &= A_{\text{I}} + A_{\text{II}} + A_{\text{III}} \\ 9 \cdot 4 &= \frac{1}{2} \cdot 4 \cdot 4 + \frac{1}{2} \cdot 2 \cdot 9 + \frac{1}{2} \cdot 2 \cdot 5 \\ 36 &= 8 + 9 + 5 \\ &= 14 \text{ u}^2 \end{aligned}$$

Area  $\triangle BCA = 14.00 \text{ cm}^2$ 

In General

$A_{\text{rect}} - A_I - A_{II} - A_{III}$   
 $ad - \frac{1}{2}cd - \frac{1}{2}ab - \frac{1}{2}(a-c)(d-b)$   
 $ad - \frac{1}{2}cd - \frac{1}{2}ab - \frac{1}{2}(ad - ab + bd - bc)$   
 $ad - \frac{1}{2}cd - \frac{1}{2}ab - \frac{1}{2}ad + \frac{1}{2}ab + \frac{1}{2}cd - \frac{1}{2}bc$   
 $\frac{1}{2}ad - \frac{1}{2}bc$   
 $= \frac{1}{2}(ad - bc)$

$A_{\Delta} = \frac{1}{2} \begin{vmatrix} a & b \\ c & d \end{vmatrix}$

Counterclockwise +  
Clockwise -

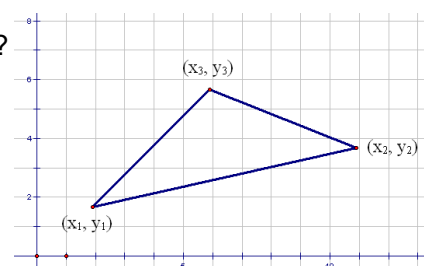
Example:  
Find the area  
(0, 0), (5, 2) (4, 6)

$$A = \frac{1}{2} \begin{vmatrix} 5 & 2 \\ 4 & 6 \end{vmatrix} = 11 \text{ u}^2$$

Do:  
Find the area.  
(0, 0), (5, -3) (-10, 9)

$$A = 7.5 \text{ u}^2$$

What if...?



$$A = \frac{1}{2} \left[ \begin{vmatrix} x_1 & y_1 \\ x_2 & y_2 \end{vmatrix} + \begin{vmatrix} x_2 & y_2 \\ x_3 & y_3 \end{vmatrix} + \begin{vmatrix} x_3 & y_3 \\ x_1 & y_1 \end{vmatrix} \right]$$

Ex:

Find the area:

(3, 8) (5, 1) (-1, 2)

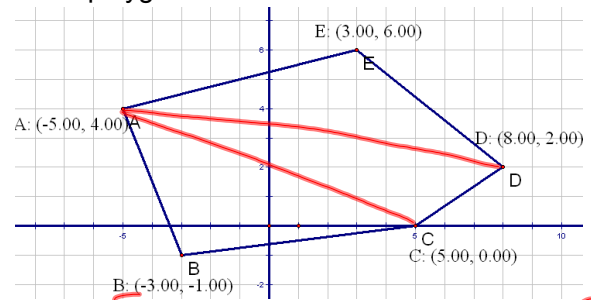
$$A = \frac{1}{2} \left[ \begin{vmatrix} 3 & 8 \\ 5 & 1 \end{vmatrix} + \begin{vmatrix} 5 & 1 \\ -1 & 2 \end{vmatrix} + \begin{vmatrix} -1 & 2 \\ 3 & 8 \end{vmatrix} \right]$$

$$\frac{1}{2} \left[ -37 + 11 - 14 \right]$$

$$\frac{1}{2} (-40)$$

$$A = 20 \text{ u}^2$$

Other polygons



$$A = \frac{1}{2} \left[ \begin{vmatrix} -5 & 4 \\ -3 & -1 \end{vmatrix} + \begin{vmatrix} -3 & -1 \\ 5 & 0 \end{vmatrix} + \begin{vmatrix} 5 & 0 \\ 8 & 2 \end{vmatrix} + \begin{vmatrix} 8 & 2 \\ 3 & 6 \end{vmatrix} + \begin{vmatrix} 3 & 6 \\ -5 & 4 \end{vmatrix} \right]$$

$$= 58 \text{ u}^2$$